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EXAMINER
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ART UNIT	PAPER NUMBER
1765	11

DATE MAILED: 01/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Offic Action Summary	Application No. 09/800,495	Applicant(s) HIROSE ET AL.	
	Examiner Lynette T. Umez-Eronini	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period f r Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,5,6 and 9-28* is/are pending in the application.

4a) Of the above claim(s) *5,6 and 21-23* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 9-20 and 24-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *5,6 and 21-23* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of claims in Paper No. 10 is acknowledged. The traversal is on the ground(s) that invention I, claims 1-2, 9-11, and 18-20, drawn to a method and invention III, claims 5-6, 21-23, drawn to an apparatus both recite irradiation of light onto a film formed on a surface of the wafer and the Examiners' contention concerning "polishing a bulk substrate without surface layers" does not relate to either process or apparatus as claimed and has failed to properly set forth distinctness. This is not found persuasive because inventions I and II are distinct because they are respectively drawn to a polishing method and polish apparatus, which would each have a different classification and would require different area for examination and irradiating light onto a film recites a method limitation and fails to limit an apparatus.

The requirement is still deemed proper and is therefore made FINAL.

However, applicant has amended claims in invention II and presented persuasive arguments, which had overcome the restriction requirement of invention II, claims 12-17.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 9 and 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 9, line 9, "predetermined" is indefinite because it

In claim 9, line 2;

In claim 25, line 2, "light having predetermined characteristics" is indefinite because it is unclear by what is meant by light characteristics. Are light characteristics the wave and particle property of light?

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claim 1, 18, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Aiyer et al. (US 5,838,448).

Aiyer teaches a method of detecting an endpoint of polishing processing. The method comprises the steps of:

Detecting thin film thickness or thickness change during CMP use thin film reflectance variations caused by a change in the incidence angle of the incident light (column 2, lines 63-66) and illuminating wafer **28** from its backside by an infrared source

of illumination and if the wafer **28** with film **24** is alternatively illuminating from its frontside, a different wavelength (column 3, lines 39-44), read on,

concurrently irradiating a film formed on a surface of a wafer under polishing processing with light having predetermined characteristics;

Using detection fibers **38** to detect the reflected light intensity over a range of angles (column 4, lines 38-41), reads on,

detecting respective reflected light from the insulating film on said wafer surface generated by the irradiation;

Combining the intensity of the light reflected at the wafer-oxide interface and at the rough surface of the oxide and at the rough surface of the oxide **24** after transmission through the wafer **28** is designated I_r (column 3, lines 49-51), which is calculated from parameters such as the thickness of the oxide layer, the refractive index of the oxide and wafer, the wavelength of light (λ), and the intensity of the reflected light signal by substitution in the light equation (column 3, lines 15-17 and column 3, line 50 - column 4, line 23), reads on,

detecting the endpoint of polishing processing of said film on the basis of a relationship between intensities of the detected reflected lights.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('448) as applied to claim 1 above, and further in view of Sandhu (US 5,865,666).

Aiyer differs in failing teach using the endpoint of polishing processing is detected on the basis of an intensity ratio of the said detected reflected lights.

Sandhu teaches a cmp detection endpoint method based on comparing the actual intensity of the reflected light beam **86** with an expected intensity at the endpoint of the CMP process (column 6, lines 43-58).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer by detecting the endpoint of polishing on the basis of the intensity ratio of the detected reflected lights for the purpose of accurately detecting the endpoint of the CMP process at critical (selected endpoint site on a wafer) areas on a wafer (column 7, lines 11-26 and column 2, lines 51-54).

8. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('448) as applied to claim 1 above, and further in view of Birang (US 5,964,643).

Aiyer differs in failing to teach irradiating the surface of said wafer under polishing processing with a UV light and detecting a UV light reflected on the surface of said wafer by the irradiation.

Birang teaches a method of directing a light beam toward the layer during polishing and monitoring the light reflecting off the substrate (Abstract) and employing a

wavelength anywhere from the far infrared to ultraviolet (column 17, lines 45-47), which reads on, irradiating the surface of said wafer under polishing processing with a UV light and detecting a UV light reflected on the surface of said wafer by the irradiation.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer by using UV light as taught by Birang for the purpose of removing less material during a polishing cycle (column 17, lines 52-60).

9. Claims 9, 24, 25, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Woo (WO 99/30109), Pollock (US 5,770,521) and Cadien et al. (US 5,954,975).

Aiyer teaches a method of manufacturing a semiconductor device. The method comprises the steps of:

forming an insulating film on a surface of a wafer (column 3, lines 26-27 and column 2, lines 14);

attaching the wafer having the insulating film formed on the surface to a polishing processing machine (column 3, lines 24-29 and column 2, lines 15-16); and

"the lower rough surface of the silicon dioxide film **24** rests on the polishing pad **20** as is being polished by the polishing pad **20** (column 3, lines 28-31), reads on,

starting polishing processing of the wafer attached to the polishing processing machine;

Detecting thin film thickness or thickness change during CMP use thin film reflectance variations caused by a change in the incidence angle of the incident light (column 2, lines 63-66) and illuminating wafer 28 from its backside by an infrared source of illumination and if the wafer 28 with film 24 is alternatively illuminating from its frontside, a different wavelength (column 3, lines 39-44), read on,

concurrently irradiating a film formed on a surface of a wafer under polishing processing with light having predetermined characteristics;

Using detection fibers 38 to detect the reflected light intensity over a range of angles (column 4, lines 38-41), reads on,

detecting respective reflected light from the insulating film on said wafer surface generated by the irradiation;

Combining the intensity of the light reflected at the wafer-oxide interface and at the rough surface of the oxide and at the rough surface of the oxide **24** after transmission through the wafer **28** is designated I_r (column 3, lines 49-51), which is calculated from parameters such as the thickness of the oxide layer, the refractive index of the oxide and wafer, the wavelength of light (λ), and the intensity of the reflected light signal by substitution in the light equation (column 3, lines 15-17 and column 3, line 50 - column 4, line 23), reads on,

detecting the endpoint of polishing processing of said film on the basis of a relationship between intensities of the detected reflected lights.

Aiyer differs in failing to teach stopping polishing processing of said wafer on which the endpoint is detected.

Woo teaches an endpoint detection method wherein changes in the wafer surface is optically monitored and when the appearance of the wafer surface changes, an endpoint is signaled and polishing is stopped thereafter (page 2, lines 27-35).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer by using Woo's method of stopping the endpoint polishing process for the purpose of determining CMP endpoints on transparent layers such as an insulating oxide as well as on opaque metal layer (page lines 12-21).

Aiyer in view of Woo differs in failing to teach detaching the wafer whose polishing processing is stopped from said polishing processing machine.

Pollock teaches a polishing apparatus that is in an opened position, after removal of a semiconductor wafer from a polishing pad after completion of the polishing cycle (FIG. **3**; column 3, lines 1-5; column 4, lines 28-29 and 40-41 and Abstract).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Woo by using Pollock's method of removing a wafer from a polishing machine for the purpose of reducing the sticking of semiconductor wafers on a chemical mechanical polishing machine polishing pad (column 2, lines 6-9).

Aiyer in view of Woo and Pollock differs in failing to teach forming a new wiring pattern on said insulating film of the wafer is detached from said polishing processing machine.

Cadien teaches, "After completion of the CMP process, as shown in FIG. 3e, an interconnect line **324** (same as wiring pattern) is formed on ILD **302** (same as insulating layer) and on tungsten plug **322**. Interconnect line **324** can be formed by blanket depositing a conductive layer of, for example, aluminum alloys, tungsten, copper, etc., over ILD 302 and tungsten plug 322" (column 9, lines 45-50), which reads on forming a wiring pattern on insulating film of the wafer detached from said polishing processing machine.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Woo and Pollock by using Cadien's method of forming a wiring layer for the purpose of fabricating of a planar, highly reliable, low resistance, high density electrical connection between two conductive layers of an integrated circuit (column 9, lines 62-65).

Claim Rejections - 35 USC § 103

10. Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Woo (WO 99/30109), Pollock ('521) and Cadien ('975) as applied to claim 9 above, and further in view of Hiyama et al. (US 5,838,447).

Aiyer in view of Woo and Pollock differs in failing to teach a polishing rate of the film is evaluated on the basis of the intensities of said detected reflected lights so as to

change dressing conditions of a dresser to a pad used for polishing processing on the basis of the evaluation result, in claim 10 and wherein said dressing conditions include at least one of a dressing pressure in claim 11.

Hiyama teaches, "The computing unit **12** calculates the thickness of the oxide layer of the semiconductor wafer **2** from the sum value and compares the sum value with an initial value which has been stored, i.e., an initial value indicative of the intensities of light reflected from the semiconductor wafer **2** before it is polished, and calculates a polishing rate from the absolute value of the difference between the sum value and the initial value which are compared with each other (column 5, lines 6-15). The aforementioned reads on,

a polishing rate of the film is evaluated on the basis of the intensities of said detected reflected lights so as to change dressing conditions of a dresser to a pad used for polishing processing on the basis of the evaluation result.

Hiyama also teaches, "A constant polishing rate can be obtained by controlling the operating parameters (such as pressure exerted by the top ring or rotational speeds of the turntable and the top ring) of the polishing apparatus on the basis of the obtained data. Further, a service life of the polishing cloth can be judged or estimated, an a dressing parameter for dressing the polishing cloth after the polishing process can be also determined" (column 5, lines 34-42), which reads on,

wherein said dressing conditions include at least one of a dressing pressure.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of

Woo, Pollock, and Cadien by using Hiyama's polishing detection method for the purpose of reducing polishing time and labor (column 2, lines 14-16).

11. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Woo (WO 99/30109), Pollock (US 5,770,521) and Cadien et al. (US 5,954,975) as applied to claim 9 above, and further in view of Sandhu (US 5,865,666).

Aiyer in view of Woo, Pollock, and Cadien differs in failing teach using the endpoint of polishing processing is detected on the basis of an intensity ratio of the said detected reflected lights.

Sandhu teaches a cmp detection endpoint method based on comparing the actual intensity of the reflected light beam **86** with an expected intensity at the endpoint of the CMP process (column 6, lines 43-58).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Woo, Pollock, and Cadien by detecting the endpoint of polishing on the basis of the intensity ratio of the detected reflected lights for the purpose of accurately detecting the endpoint of the CMP process at critical (selected endpoint site on a wafer) areas on a wafer (column 7, lines 11-26 and column 2, lines 51-54).

12. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Woo (WO 99/30109), Pollock (US'521) and Cadien et al. ('975) as applied to claim 9 above, and further in view of Birang (US 5,964,643).

Aiyer in view of Woo, Pollock, and Cadien differs in failing to teach the light is UV light.

Birang teaches a method of directing a light beam toward the layer during polishing and monitoring the light reflecting off the substrate (Abstract) and employing a wavelength anywhere from the far infrared to ultraviolet (column 17, lines 45-47), which reads on, irradiating the surface of said wafer under polishing processing with a UV light and detecting a UV light reflected on the surface of said wafer by the irradiation.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer by using UV light as taught by Birang for the purpose of removing less material during a polishing cycle (column 17, lines 52-60).

Claim Rejections - 35 USC § 103

13. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Woo (WO 99/30109), Pollock ('521) and Cadien ('975).

Aiyer teaches a method of manufacturing a semiconductor device. The method comprises the steps of:

forming an insulating film on a surface of a wafer (column 3, lines 26-27 and column 2, lines 14);

attaching the wafer having the insulating film formed on the surface to a polishing processing machine (column 3, lines 24-29 and column 2, lines 15-16); and

"the lower rough surface of the silicon dioxide film **24** rests on the polishing pad **20** as is being polished by the polishing pad **20** (column 3, lines 28-31), reads on,

starting polishing processing of the wafer attached to the polishing processing machine;

Detecting thin film thickness or thickness change during CMP use thin film reflectance variations caused by a change in the incidence angle of the incident light (column 2, lines 63-66) and illuminating wafer **28** from its backside by an infrared source of illumination and if the wafer **28** with film **24** is alternatively illuminating from its frontside, a different wavelength (column 3, lines 39-44), read on,

irradiating the surface of said wafer under polishing processing with light;

Using detection fibers **38** to detect the reflected light intensity over a range of angles (column 4, lines 38-41), reads on,

detecting respective reflected light from the insulating film on said wafer surface generated by the irradiation;

Combining the intensity of the light reflected at the wafer-oxide interface and at the rough surface of the oxide and at the rough surface of the oxide **24** after transmission through the wafer **28** is designated I_r (column 3, lines 49-51), which is calculated from parameters such as the thickness of the oxide layer, the refractive index of the oxide and wafer, the wavelength of light (λ), and the intensity of the reflected light signal by substitution in the light equation (column 3, lines 15-17 and column 3, line 50 - column 4, line 23), reads on,

detecting the endpoint of polishing processing of said film on the basis of a relationship between intensities of the detected reflected lights.

Aiyer differs in failing to teach stopping polishing processing of said wafer on which the endpoint is detected.

Woo teaches an endpoint detection method wherein changes in the wafer surface is optically monitored and when the appearance of the wafer surface changes, an endpoint is signaled and polishing is stopped thereafter (page 2, lines 27-35).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer by using Woo's method of stopping the endpoint polishing process for the purpose of determining CMP endpoints on transparent layers such as an insulating oxide as well as on opaque metal layer (page lines 12-21).

Aiyer in view of Woo differs in failing to teach detaching the wafer whose polishing processing is stopped from said polishing processing machine.

Pollock teaches a polishing apparatus that is in an opened position, after removal of a semiconductor wafer from a polishing pad after completion of the polishing cycle (FIG. **3**; column 3, lines 1-5; column 4, lines 28-29 and 40-41 and Abstract).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Woo by using Pollock's method of removing a wafer from a polishing machine for the

purpose of reducing the sticking of semiconductor wafers on a chemical mechanical polishing machine polishing pad (column 2, lines 6-9).

Aiyer in view of Woo and Pollock differs in failing to teach forming a new wiring pattern on said insulating film of the wafer is detached from said polishing processing machine.

Cadien teaches, "After completion of the CMP process, as shown in FIG. 3e, an interconnect line **324** (same as wiring pattern) is formed on ILD **302** (same as insulating layer) and on tungsten plug **322**. Interconnect line **324** can be formed by blanket depositing a conductive layer of, for example, aluminum alloys, tungsten, copper, etc., over ILD 302 and tungsten plug 322" (column 9, lines 45-50), which reads on forming a wiring pattern on insulating film of the wafer detached from said polishing processing machine.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Woo and Pollock by using Cadien's method of forming a wiring layer for the purpose of fabricating of a planar, highly reliable, low resistance, high density electrical connection between two conductive layers of an integrated circuit (column 9, lines 62-65).

14. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Woo (WO 99/30109), Pollock ('521) and Cadien ('975), as applied to claim 12 above, and further in view of Hiyama et al. (US 5,838,447).

Aiyer in view of Woo and Pollock differs in failing to teach a polishing rate of the film is evaluated on the basis of the intensities of said detected reflected lights so as to change dressing conditions of a dresser to a pad used for polishing processing on the basis of the evaluation result, in claim 10 and wherein said dressing conditions include at least one of a dressing pressure in claim 11.

Hiyama teaches, "The computing unit **12** calculates the thickness of the oxide layer of the semiconductor wafer **2** from the sum value and compares the sum value with an initial value which has been stored, i.e., an initial value indicative of the intensities of light reflected from the semiconductor wafer **2** before it is polished, and calculates a polishing rate from the absolute value of the difference between the sum value and the initial value which are compared with each other (column 5, lines 6-15). The aforementioned reads on,

a polishing rate of the film is evaluated on the basis of the intensities of said detected reflected lights so as to change dressing conditions of a dresser to a pad used for polishing processing on the basis of the evaluation result.

Hiyama also teaches, "A constant polishing rate can be obtained by controlling the operating parameters (such as pressure exerted by the top ring or rotational speeds of the turntable and the top ring) of the polishing apparatus on the basis of the obtained data. Further, a service life of the polishing cloth can be judged or estimated, an a dressing parameter for dressing the polishing cloth after the polishing process can be also determined" (column 5, lines 34-42), which reads on,

wherein said dressing conditions include at least one of a dressing pressure.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Woo and Pollock by using Hiyama's polishing detection method for the purpose of reducing polishing time and labor (column 2, lines 14-16).

15. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Birang ('643), Woo (WO 99/30109), Pollock ('521) and Cadien ('975).

Aiyer teaches a method of manufacturing a semiconductor device. The method comprises the steps of:

forming an insulating film on a surface of a wafer (column 3, lines 26-27 and column 2, lines 14);

attaching the wafer having the insulating film formed on the surface to a polishing processing machine (column 3, lines 24-29 and column 2, lines 15-16); and

"the lower rough surface of the silicon dioxide film **24** rests on the polishing pad **20** as is being polished by the polishing pad **20** (column 3, lines 28-31), reads on,

starting polishing processing of the wafer attached to the polishing processing machine;

Detecting thin film thickness or thickness change during CMP use thin film reflectance variations caused by a change in the incidence angle of the incident light (column 2, lines 63-66) and illuminating wafer **28** from its backside by an infrared source of illumination and if the wafer **28** with film **24** is alternatively illuminating from its frontside, a different wavelength (column 3, lines 39-44), read on,

irradiating the surface of said wafer under polishing processing with light;

Using detection fibers **38** to detect the reflected light intensity over a range of angles (column 4, lines 38-41), reads on,

detecting respective reflected light from the insulating film on said wafer surface generated by the irradiation;

Combining the intensity of the light reflected at the wafer-oxide interface and at the rough surface of the oxide and at the rough surface of the oxide **24** after transmission through the wafer **28** is designated I_r (column 3, lines 49-51), which is calculated from parameters such as the thickness of the oxide layer, the refractive index of the oxide and wafer, the wavelength of light (λ), and the intensity of the reflected light signal by substitution in the light equation (column 3, lines 15-17 and column 3, line 50 - column 4, line 23), reads on,

detecting the endpoint of polishing processing of said film on the basis of a relationship between intensities of the detected reflected lights.

Aiyer differs in failing to teach irradiating the surface of said wafer under polishing processing with a UV light and detecting a UV light reflected on the surface of said wafer by the irradiation.

Birang teaches a method of directing a light beam toward the layer during polishing and monitoring the light reflecting off the substrate (Abstract) and employing a wavelength anywhere from the far infrared to ultraviolet (column 17, lines 45-47), which reads on, irradiating the surface of said wafer under polishing processing with a UV light and detecting a UV light reflected on the surface of said wafer by the irradiation.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer by using UV light as taught by Birang for the purpose of removing less material during a polishing cycle (column 17, lines 52-60).

Aiyer in view of Birang differs in failing to teach stopping polishing processing of said wafer on which the endpoint is detected.

Woo teaches an endpoint detection method wherein changes in the wafer surface is optically monitored and when the appearance of the wafer surface changes, an endpoint is signaled and polishing is stopped thereafter (page 2, lines 27-35).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Birang by using Woo's method of stopping the endpoint polishing process for the purpose of determining CMP endpoints on transparent layers such as an insulating oxide as well as on opaque metal layer (page lines 12-21).

Aiyer in view of Birang and Woo differs in failing to teach detaching the wafer whose polishing processing is stopped from said polishing processing machine.

Pollock teaches a polishing apparatus that is in an opened position, after removal of a semiconductor wafer from a polishing pad after completion of the polishing cycle (FIG. **3**; column 3, lines 1-5; column 4, lines 28-29 and 40-41 and Abstract).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Birang and Woo by using Pollock's method of removing a wafer from a polishing

machine for the purpose of reducing the sticking of semiconductor wafers on a chemical mechanical polishing machine polishing pad (column 2, lines 6-9).

Aiyer in view of Birang, Woo, and Pollock differs in failing to teach forming a new wiring pattern on said insulating film of the wafer is detached from said polishing processing machine.

Cadien teaches, "After completion of the CMP process, as shown in FIG. 3e, an interconnect line **324** (same as wiring pattern) is formed on ILD **302** (same as insulating layer) and on tungsten plug **322**. Interconnect line **324** can be formed by blanket depositing a conductive layer of, for example, aluminum alloys, tungsten, copper, etc., over ILD 302 and tungsten plug 322" (column 9, lines 45-50), which reads on forming a wiring pattern on insulating film of the wafer detached from said polishing processing machine.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Birang, Woo, and Pollock by using Cadien's method of forming a wiring layer for the purpose of fabricating of a planar, highly reliable, low resistance, high density electrical connection between two conductive layers of an integrated circuit (column 9, lines 62-65).

16. Claims 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aiyer ('388) in view of Birang ('643), Woo (WO 99/30109), Pollock ('521) and

Cadien ('975), as applied to claim 15 above, and further in view of Hiyama et al. (US 5,838,447).

Aiyer in view of Birang, Woo, Pollock, and Cadien differs in failing to teach a polishing rate of the film is evaluated on the basis of the intensities of said detected reflected lights so as to change dressing conditions of a dresser to a pad used for polishing processing on the basis of the evaluation result, in claim 16 and wherein said dressing conditions include at least one of a dressing pressure in claim 17.

Hiyama teaches, "The computing unit **12** calculates the thickness of the oxide layer of the semiconductor wafer **2** from the sum value and compares the sum value with an initial value which has been stored, i.e., an initial value indicative of the intensities of light reflected from the semiconductor wafer **2** before it is polished, and calculates a polishing rate from the absolute value of the difference between the sum value and the initial value which are compared with each other (column 5, lines 6-15). The aforementioned reads on,

a polishing rate of the film is evaluated on the basis of the intensities of said detected reflected lights so as to change dressing conditions of a dresser to a pad used for polishing processing on the basis of the evaluation result.

Hiyama also teaches, "A constant polishing rate can be obtained by controlling the operating parameters (such as pressure exerted by the top ring or rotational speeds of the turntable and the top ring) of the polishing apparatus on the basis of the obtained data. Further, a service life of the polishing cloth can be judged or estimated,

an a dressing parameter for dressing the polishing cloth after the polishing process can be also determined" (column 5, lines 34-42), which reads on,

wherein said dressing conditions include at least one of a dressing pressure.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Aiyer in view of Birang, Woo, Pollock, and Cadien by using Hiyama's polishing detection method for the purpose of reducing polishing time and labor (column 2, lines 14-16).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable reached on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703-308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703-972-9310 for regular communications and 703-972-9311 for After Final communications.

Lynette T. Umez-Eronini

Itue
January 13, 2003